

29 Oct 1960

ADM. ORG. NAS. Space SC DC  
Committees: Exobiology:  
Meetings  
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Exob. 8-9

## MEETING AT STANFORD UNIVERSITY, 29 OCTOBER 1960

Topics for Discussion

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1. Mars 1964?
2. Mars 1962?
3. The spectra of the earth.
4. COSPAR, April 1961
5. Further plans for Mars, 1966-67.
6. Extrapolation beyond the first landing experiments
7. What could we do with tonnage landing capability for the 1969-1971 oppositions (say just short of a return trip).
8. Remarks on Mohole.
9. Efforts and plans at Stanford.
10. Further briefings.
11. How often do you want to meet?
12. Enclosures - Exob. 8-8: Lederberg comment on Mars 1962 and note enclosed thermofax and reference to "KK12".
13. Useful experiments in other aspects of space biology.

1. Mars 1964?

A. The definitive missions to Mars will be based on Saturn capabilities, probably not available before a 1967 opposition. These flights may be able to accommodate as much as 100-200 pounds of instruments and have communication band widths ample for almost any conservative observations we could design. A lead time of 4-5 years for preliminary design and 2-3 years for first prototypes is indicated as needed to mount these experiments on the missions.

Meanwhile there is some discussion of the possibility of an earlier flight (1964-65) which may be a good flyby, an orbiter, or a very much reduced drop-sonde: a few pounds and a few bits. There is not much time to prepare for this possibility, and it is not certain in any event, how realistic it is. Should Mars 1964 be a lander? Would an extended flight (Kite or balloon) in the atmosphere be preferable? What information should be sought? Should space be taken for a (necessarily primitive) biological detector? Or are physical measurements more pressing and useful for the success of the later flights? Which ones in particular? (Cf. enclosure 8-8).

B. If we had the capacity to test just 20 culture media for their ability to support growth of Martian microbes, what would be your concrete recommendations: list 1-20 including the basal medium (a final answer is not to be had now but let us get underway with preliminary recommendations). Include provisions for controls and redundancy.

2. Mars 1962?

How strong should be the backing for the proposed 1962 flyby? Is our home-work good enough to justify the \$11,000,000, or should similar funds and our efforts be spent to concentrate on terrestrial analogs? Hopefully, we may be briefed on some of these points:

Davies - present state of policy and instruments

Calvin - spectra of planetary models

3. The spectrum of the earth.

Many of us doubt that we can evaluate Mars 1962 without better data on the earth. The present status of high altitude data and prospects should be discussed - perhaps led by Carl Sagan. (Note the following published reference to upwelling light in the visible at 60 - 70,000 feet which did distinguish various types of terrain: Toolin, Robert B. and Vincent J. Stakutis, 1958. Qualitative indication of nadir sky blue. J. Optical Society of America 48: 71-72.)

4. COSPAR, April 1961.

COSPAR is expected to meet again in Europe in April 1961. (The Space Science Board formally represents the U.S. in international relationships through COSPAR and this is one of its most important unique functions.) Have we any proposals for discussion of exobiology problems? (I have recommended, for the time being, against a formal program as the material content would be too thin. But should we urge an informal discussion? A closed one? With whom - from U.S. - from U.S.S.R.? Do we have a concrete enough program?)

5. Further plans for Mars, 1966-67.

Which new stones need to be turned over for Mars 1966-7 and who can do the turning? Discussion of approaches in document 8-5.

6. Extrapolation beyond the first landing experiments.

Can we anticipate the next steps that would follow Mars 1966 if

- a) there is video evidence of intelligent life
- b) if not, but indications of microorganisms
- c) if neither but the experiment seems to have been performed according to expectations from a technical standpoint.

If we cannot go any further without the realization of new physical data, we may need 3-4 years more to mount a subsequent experiment and even longer if we do not meet the oppositions.

7. What could we do with a tonnage landing capability for the 1969-71 oppositions?

(Items 6 and 7 may not be reached for detailed discussion at this meeting, but they represent one of our basic tasks and responsibilities to the Space Science Board. Papers on these subjects would be most appropriate and will be circulated where they can be of some effect.)

8. Remarks on Mohole.

Preliminary drillings will soon get underway for testing certain features of the Mohole project. Willard Bascom who is coordinating this project out of an office at the National Academy of Sciences in Washington called recently to ask the nature of specific biological interest in deep and presumably ancient sediments. Ben Volcani at La Jolla is interested in this - perhaps Dr. Miller might bring up some word as to the plans that are being hatched there. From both a technical and conceptual standpoint, there might be some liaison

between infra- and exobiology.

9. Efforts and plans at Stanford.

I will be happy to have an opportunity to discuss some of what we have been doing and more of what we hope to do in the experimental work here. The greatest encouragement has come from the very efficient use of the flotation technique which may make it realistic to short cut the problematical cultivation step in looking for rare microorganisms. The output from a flotation fractionation can then be looked at by the microscope-microspectrophotometer; by semi-microspectrophotometry if we can solve some problems relating to the measurement of turbid suspensions; and for the semi-micro determination of certain types of enzyme activity, for example ATPase and nuclease. The fourth approach, which has been developed under considerable pressure to meet the possible requirements of Mars 1964 is the multivator and we are starting to put together some laboratory models.

10. Further briefings.

Briefing reports are herewith solicited from the following, including some already indicated above:

Young or Randt (NASA Headquarters) - General program and what we can do to help.

Davies or Hobby (JPL) - Mars 1962

Calvin and Weaver - Mars 1962 groundwork - IR reflection spectra (some actual curves?) - chemistry of carbonaceous meteorites

Sagan - High altitude observations

Dunkelman (if he can come) - Solar ultraviolet; measurements and techniques; UV filters and spectrometry

Miller and Sagan - Synthesis in simulated planetary atmospheres

Miller - ? report from Volcani on Mohole plans

Horowitz - Goetz particle spectrometer

Those of you not specifically mentioned are invited to bring up new business.

Committees 15 and 16 have now been established to take care of other aspects of biology and to scrutinize man in space. They would appreciate any comment we would care to make concerning appropriate experiments for fundamental biology in space apart from exobiology.

J. Lederberg